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MAIZE PRODUCTION

1983-84

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PREFACE

The Department of Scientific and Industrial Research Crop Research Division engaged the Agricultural Economics Research Unit (A.E.R.U.) to undertake a review of the maize industry such that future maize research can be undertaken with some knowledge of future production trends.

The following report prepared by Roger Lough, Senior Research Economist with the A.E.R.U. is based upon the field work and preparatory report prepared by Alister Rayne, B.Ag.Sc. The field work was undertaken in July and August 1984 and refers to the 1983-84 production year.

This Discussion Paper and a forthcoming Discussion Paper (Hughes and Sheppard) present the results of the review of the maize industry. Discussion Papers 89 and 90 on the cereal industry and the pig industry, respectively, complement this publication.

R.G. Lattimore
Director.

SECTION 1

BACKGROUND TO MAIZE PRODUCTION

Maize is used primarily for domestic requirements in compound stock food, starch, distilling, breakfast foods, with limited amounts exported. A small area of maize is used as a fodder crop (3813 ha in 1982) for cattle and sheep. Grown in the North Island, maize is susceptible to cool summer temperatures which prevent extensive South Island plantings of high yielding varieties. The versatility of maize in its uses as grain, greenfeed and silage gives it a significant advantage over other crops.

Maize exports are small being 22,471 tonnes in 1980/81, returning $3.33m f.o.b.: Iran (56%), Fiji (27%), New Caledonia (9%) Western Samoa (5%), Singapore and Fiji were the major export markets.

Imports are small and strictly controlled. Diseases such as 'southern leaf blight' and 'boil smut' being of primary concern. Imports are used as basic seed sources although the New Zealand Starch Company is able to utilise imported maize since it is sterilised during processing.

The distribution of maize grains production for the 1981 and 1982 harvest is presented in Table 1.

In excess of 99.0 percent of total maize production is concentrated in the North Island with the South Auckland-Bay of Plenty area producing two-thirds of the total North Island crop. Sixty one percent of the increased production between 1981 and 1982 can be attributed to an increase in the area of maize planted in the South Auckland-Bay of Plenty districts.

Per hectare production has increased from 3.9 tonnes per hectare in 1961 to 9.1 tonnes per hectare in 1982. The increase in per hectare production has partly offset a decline in area which peaked at 28,600 ha in 1977.

Much of the increased yield is attributed to improved cultivars. Prior to the late 1960's the hybrid seed production was controlled by the Department of Agriculture, but increases in maize areas led to the involvement of seed firms. Seed merchants now develop, produce and market imported seed hybrids in association with the United States franchise holders. In 1969 'southern leaf blight' devastated United States maize crops leading to the establishment of the first post-quarantine growing area in New Zealand for maize cultivars. This allowed continued cultivar development without the risk of importing exotic diseases.

TABLE 1

New Zealand Maize Distribution

Region	ha		tonnes		tonnes/ha	
	1981	1982	1981	1982	1981	1982
North Island						
Northland	501	344	3560	1846	7.1	5.4
Central Auckland	304	201	2491	1686	8.2	8.4
South Auckland-Bay of Plenty	10891	12086	98700	110397	9.1	9.1
East Coast	2557	2650	22730	26348	8.9	9.9
Hawkes Bay	1082	1319	10179	11677	9.4	8.9
Taranaki	210	383	1777	3713	8.5	9.7
Wellington	1348	1614	10489	13344	7.8	8.3
N.I. sub-total	16893	18597	149926	169011	8.9	9.1
South Island						
Marlborough	167	77	1031	494	6.2	6.4
Nelson	146	76	1053	566	7.2	7.4
Canterbury	18	-	70	-	3.8	-
S.I. sub-total	331	153	2154	1060	5.7	6.9
NEW ZEALAND TOTAL	17224	18750	152080	170071	8.8	9.1

Source: Agricultural Statistics 1981/82.

The Crop Research Division of the Department of Scientific and Industrial Research (DSIR) initiated its breeding programme in 1968 to produce superior hybrids for New Zealand conditions by isolating specific gene sources and incorporating these into United States bred seed lines. The Plant Physiology Division of the DSIR established a breeding programme in 1976 which involved an evaluation of hybrids and assesses fertiliser requirements, weed and pest control, plant population and sowing times.

The New Zealand maize price varies seasonally and according to the region in which it is grown. Based on market proximity, Waikato and Manawatu growers receive higher prices than Poverty Bay and the Bay of Plenty growers. Exports favour Poverty Bay because Gisborne is used as the export port.

'Cribbed' maize receives a higher price than 'picker-shelled' maize by way of a storage increment. The cribbed maize is usually of higher quality but, as yet, there is no quality based pricing system.

A large proportion of maize is grown under contract to merchants who also provide the necessary chemical, seed and fertiliser inputs as well as seasonal finance.

A price stabilisation fund was established in 1975 to give confidence to the industry by stabilising prices. Gisborne and Bay of Plenty growers who, it was argued, were vulnerable to variable export prices for grain exported through Gisborne and a local New Zealand market which could only be supplied if high internal transport costs could be absorbed, stood to benefit from the establishment of such a fund, at the expense of growers in other regions.

The fund was controlled by the Maize Stabilisation Fund Committee consisting of 4 growers, 5 merchants and one government representative. Maize was levied at $3.00-$4.00 per tonne depending on the season. The fund operated by reimbursing merchants the deficit, if any, between the internal price and the export price. Problems arose in 1981/82 from regional disagreements after the fund failed to meet its obligations to all the grain merchants concerned.

In the 1983/84 season a number of Gisborne growers co-operated in an effort to market their crop in the Waikato area. By pooling their resources, freight rates and drying costs were reduced, making the operation viable.

The devaluation in 1984 effectively placed export prices well above the New Zealand maize price, further reducing the need for a Stabilisation Fund to assist Gisborne and Bay of Plenty growers.

Agreement on maize marketing was reached in November 1984. Participation contracts are to be introduced, whereby a company would market to best advantage, growers' maize supplied to a specific pool. Growers are also to be given the option of a fixed price contract or the right to sell on the free market. Fixed price contracts for the 1984-85 season are as follows:

	$/tonne
Waikato and Bay of Plenty	$235
Manawatu	$230
Poverty Bay	$218

Stability is considered by growers to be essential to the maize industry. However, because maize can be grown over such a wide area, it will continue to be subject to a fluctuating supply.

SECTION 2

CHARACTERISTICS OF MAIZE PRODUCING FARMS

This section describes the general characteristics of a maize producing farm. Data is presented on a regional basis for the four major producing areas. The data presented were obtained through a sample survey of maize producing farms in each region. The survey was carried out during July and August 1984. As the sample size was small, on a regional basis, regional results must be interpreted with caution due to the large potential error involved in a sample of this size. However, on a national basis, the sample can be considered an adequate indication of the maize producing farms population.

The survey undertaken involved on-farm interviews with farmers and an examination of farmer accounts relating to the 1983-84 production year.

2.1 Farm Description, Farm Area and Cropping Policy

The Manawatu, Poverty Bay and Waikato areas have relatively similar farm areas (around 150 ha.) with a similar proportion available for cropping (approximately 65%) (Table 2). Bay of Plenty properties were significantly smaller at 64.6 hectares but with 81 percent of these properties suitable for cropping production, greater intensification of crop production was possible (Table 2).

Both Bay of Plenty and Waikato producers specialised in maize production. Maize production in Poverty Bay was more diversified with greater involvement in peas, sweetcorn and other vegetable production for Watties Canneries. While still the predominant crop, maize production in the Manawatu was only part of a balanced mixed cropping rotation involving substantial areas of wheat and lesser areas of other coarse grains, peas and small seeds.

TABLE 2

Farm and Crop Areas, 1983-84 (per farm)

		Bay of Plenty	Manawatu	Poverty Bay	Waikato	All Regions
Number of Farms Surveyed		12	10	12	11	45
Farm Area						
Total Farm Area (ha)		64.6	145.2	165.5	156.1	131.8
Potential Cropping Area (ha)		52.4	102.6	93.8	103.1	87.0
Potential Cropping Area as a Prop'n of Total Farm Area (%)		81	71	57	66	66
Cash Crop: Area Harvested						
Wheat Area	(ha)	0.0	26.5	0.0	0.0	5.9
Barley Area	(ha)	0.0	3.6	1.2	0.0	1.1
Seed Peas Area	(ha)	0.0	2.3	2.7	0.0	1.2
Vining Peas Area	(ha)	0.0	5.2	3.7	0.0	2.1
Oats Area	(ha)	0.0	2.3	0.0	0.0	0.5
Linseed Area	(ha)	0.0	0.0	0.0	0.0	0.0
Oilseed Area	(ha)	0.0	0.0	0.0	0.0	0.0
Potatoes Area	(ha)	0.0	4.4	0.0	0.0	1.0
Maize Area	(ha)	38.2	41.7	34.7	44.6	39.6
Grasseed Area	(ha)	0.0	1.5	0.0	0.0	0.3
Clover Seed Area	(ha)	0.0	0.0	0.0	0.0	0.0
Other Cash Crop Area	(ha)	1.2	1.4	11.2	1.0	3.9
Total Cash Crop Area Harvested	(ha)	39.4	88.9	53.5	45.6	55.6
Maize Area as a Prop'n of Total Cash Crop Area	(%)	97	47	65	98	71

2.2 Livestock Production

Table 3 summarises livestock production on maize producing farms and highlights the emphasis placed upon dairy and/or beef cattle. Nearly 47 percent of total stock units carried on available spring grazing are cattle.

TABLE 3

Livestock Numbers, 1983-84 (per farm)

	Bay of Plenty	Manawatu	Poverty Bay	Waikato	All Regions
Number of Farms Surveyed	12	10	12	11	45
Farm Area					
Total Farm Area (ha)	64.6	145.2	165.5	156.1	131.8
Livestock Numbers at 30.6.83					
Ewes	10	270	779	824	472
Other Sheep	8	138	112	100	87
Cattle	398	311	512	725	488
Total Stock Units	416	719	1,403	1,649	1,047
Stock Units per Available Spring Grazing Area (S.U./ha)	14.3	10.6	13.3	15.5	13.7

Carrying capacity varied from 10.6 stock units per hectare of available spring grazing in the Manawatu to 15.5 stock units per hectare in the Waikato. The Bay of Plenty area with smaller production units integrated dairy and maize production while other areas adopted a more diversified livestock policy.

2.3 Land Valuation

Table 4 presents the average land value of surveyed farms on a value per total hectare basis. These values were determined from the most recent Government Valuation and updated using the Valuation Department's "Farmland Sales Price Index".

TABLE 4

Government Valuation per Hectare

	Bay of Plenty	Manawatu	Poverty Bay	Waikato	All Regions
Number of Farms Surveyed	12	10	12	11	45
Land Value ($/ha)	4,264	2,235	3,451	5,430	3,881
Value of Improvements ($/ha)	1,642	526	1,134	1,232	1,158
Capital Value ($/ha)	5,906	2,772	4,585	6,663	5,039

The per hectare value reflects locality, alternative land uses and carrying capacity rather than maize production. Waikato with an average capital value of $6,663 per hectare carrying 15.5 stock units per hectare averaged 9.8 tonnes of maize per hectare (Table 5) while Poverty Bay with capital values of $4,585 per hectare carrying 13.3 stock units per hectare, averaged 11.4 tonnes per hectare. It is also acknowledged that the Manawatu with an average capital value of $2,772 per hectare had the lowest carrying capacity of 10.6 stock units per hectare and the lowest maize yield at 9.0 tonnes per hectare. (It should be noted that the value of $2,772 per hectare in the Manawatu is lower than might be expected. The small survey sample of 10 farms is likely to have contributed a source of error).

SECTION 3

MAIZE PRODUCTION, 1983-84

This section reviews maize production for the 1983-84 season detailing area sown, crop production and the husbandries used.

3.1 Maize Area and Production

The 1983-84 season was considered by grain merchants to be slightly better than average, though hail damage affected some Manawatu crops and flooding occurred on the East Coast. Table 5 summarises the area grown and total production per farm. Reference to Table 1 indicates that 1983-84 per hectare production on the surveyed farms was 1.0 tonne per hectare greater than the national average for 1982 and 1.3 tonnes per hectare greater than the national average for 1981.

TABLE 5

Maize Area, Production and Yield 1983-84

	Bay of Plenty	Manawatu	Poverty Bay	Waikato	All Regions
Number of Farms Surveyed	12	10	12	11	45
Area Harvested (ha)	38.7	41.7	34.7	44.6	39.7
Production (tonnes)	383.9	374.2	394.6	437.3	397.7
Saleable Production per Hectare	10.1	9.0	11.4	9.8	10.0

Per farm production was similar for the Bay of Plenty, Manawatu and Poverty Bay regions, the lower per hectare production in the Manawatu being offset by a slightly greater area grown per farm. Despite a marginally lower than average yield (9.8 tonnes per hectare compared with average production of 10.0 tonnes per hectare) Waikato with nearly 45 hectares per farm produced 40 to 50 tonnes more per farm than other regions.

Yield variations between regions are not great, although Poverty Bay in 1983-84 appeared to outyield other areas. The lower yields in the Manawatu are a reflection of a climate less suitable for maize production when compared with the more northern regions.

While 64.4 percent of the growers surveyed grew 40 hectares or

less, 11.1 percent of the growers surveyed grew more than 90 hectares of maize. Table 6 shows that these larger producers were predominantly in the Manawatu and Waikato areas.

TABLE 6

Distribution of Maize Area Planted, 1983-84

	Proportion of Farms (%)				
	Bay of Plenty	Manawatu	Poverty Bay	Waikato	All Regions
Number of Farms Surveyed	12	10	12	11	45
Maize Area Drilled (ha)					
0- 9.99	16.7	10.0	16.7	18.2	15.6
10-19.99	25.0	20.0	8.3	9.1	15.5
20-29.99	25.0	20.0	33.3	18.2	24.4
30-39.99	0.0	20.0	8.3	9.1	8.9
40-49.99	16.6	0.0	16.7	18.2	13.3
50-59.99	0.0	10.0	0.0	0.0	2.2
60-69.99	0.0	0.0	0.0	0.0	0.0
70-79.99	8.3	0.0	0.0	9.0	4.5
80-89.99	0.0	0.0	16.7	0.0	4.5
90-99.99	0.0	10.0	0.0	0.0	2.2
100 & above	8.4	10.0	0.0	18.2	8.9
Total	100.0	100.0	100.0	100.0	100.0

While the average area of maize grown per farm is nearly 40 hectares, more than 50 percent of growers grow less than 30 hectares, emphasising the influence of a small number of very large producers.

Despite high per hectare production, Poverty Bay did not attract extensive maize sowings with two-thirds of the growers surveyed growing less than 40 hectares.

3.2 Predominant Maize Varieties

Based upon data collected from growers it would appear that PX74, used extensively in the Bay of Plenty, Poverty Bay and to a lesser extent in the Waikato, and Pioneer 3901, sown extensively in the Manawatu, are the two major varieties used. Combined, these varieties represent in excess of 60 percent of the maize sown. Other preferred

TABLE 7

Predominant Maize Varieties by Proportion of Maize Area Drilled, 1983-84

	Bay of Plenty		Manawatu		Poverty Bay		Waikato		All Regions	
Number of Farms Surveyed	12		10		12		11		45	
Maize Variety	% Grown by area	Yield t/ha	% Grown by area	Yield t/ha	% Grown by area	Yield t/ha	% Grown by area	Yield t/ha	% Grown by area	Yield t/ha
PX74	100.0	10.1	0.0	0.0	76.1	11.2	21.4	9.9	30.9	10.5
Pioneer 3709	0.0	0.0	32.4	8.8	0.0	0.0	20.2	9.2	19.4	9.0
XL35	0.0	0.0	0.0	0.0	6.6	8.9	0.0	0.0	1.0	8.9
Pioneer 3591	0.0	0.0	0.0	0.0	0.0	0.0	43.5	10.0	15.2	10.0
XL72	0.0	0.0	0.0	0.0	17.2	13.2	0.0	0.0	2.6	13.2
Pioneer 3901	0.0	0.0	67.6	9.0	0.0	0.0	14.9	10.0	30.9	9.2
Total	100.0	10.1	100.0	9.0	100.0	11.4	100.0	9.8	100.0	10.1

3.3 Cultivation and Drilling

With the exception of Manawatu where wet weather delayed ground preparation, cultivation commenced in July, with the crop planted in the last week of October/first week of November. The heavy soils of Poverty Bay required on average 6.5 cultivation passes totalling 4.9 tractor hours per hectare, considerably more than the 4.7 passes totalling 3.1 tractor hours on the freer soils of the Waikato.

Compaction to the extent that sub-soiling was required was considered a serious problem in Poverty Bay and as an inconvenience in the Manawatu. Farmers in the other areas did not see soil compaction as a major constraint to maize production.

Sowing rates varied according to the seed size. Common recommendations for PX74 was 26 kg per hectare for 3R seed, and 22 kg per hectare for 3F seed. PX74 planting recommendations aim to sow 69,000 kernals per hectare for a final population of 65,800 plants per

hectare via a 19 cm. drop between seeds with 76 cms. between rows. In reality growers drilled up to 31 kg. per hectare.

TABLE 8

Cultivation Practices 1983-84

	Bay of Plenty	Manawatu	Poverty Bay	Waikato	All Regions
Number of Farms Surveyed	12	10	12	11	45
Cultivation Time including Planting (hours/ha)	4.0	3.7	4.9	3.1	4.0
Number Passes	5.3	5.5	6.5	4.7	5.5
Cultivation Commenced	21 July	6 Sept.	13 July	3 July	
Planting Date	29 Oct.	1 Nov.	2 Nov.	27 Oct.	

TABLE 9

Drilling Rates 1983-84

	Bay of Plenty	Manawatu	Poverty Bay	Waikato	All Regions
Number of Farms Surveyed which Harvested Maize	12	10	12	11	45
Planting Rate (kg/ha)					
Average	29	25	31	25	28

Planting requires a precision drill which is both expensive to buy and to maintain. Contractors are used extensively for planting. Those growers with precision drills often "contract plant" significant areas.

3.4 Fertiliser Application

While nearly all growers applied a balanced N.P.K. fertiliser at planting, wide regional differences existed regarding basal applications and side dressings. The majority of the Manawatu and Poverty Bay growers surveyed applied no basal dressings but relied upon urea as a side dressing. Table 10 summarises fertiliser application by regions.

TABLE 10

Fertiliser Application 1983-84

	Bay of Plenty	Manawatu	Poverty Bay	Waikato	All Regions
Number of Farms Surveyed	12	10	12	11	45
		Proportion of Farms %			
Basal Application					
None	0.0	60.0	66.0	18.0	36.0
Potassic Fertiliser only	17.0	10.0	25.0	27.0	19.8
Potassic Fertiliser and Nitrogen	0.0	0.0	0.0	36.0	8.7
Lime only	0.0	20.0	0.0	0.0	4.0
Lime and Potassic Fertiliser	50.0	0.0	0.0	0.0	13.6
Lime and Nitrogen	33.0	10.0	0.0	0.0	10.9
Other	0.0	0.0	9.0	19.0	7.0
Sub-total	100.0	100.0	100.0	100.0	100.0
Planting Fertiliser					
12:10:10	25.0	60.0	66.0	36.0	47.3
10:18:07	33.0	20.0	25.0	18.0	23.9
Other	42.0	20.0	9.0	46.0	28.8
Sub-total	100.0	100.0	100.0	100.0	100.0
Side Dressing					
None	33.0	30.0	0.0	18.0	21.2
Urea	0.0	60.0	100.0	45.0	49.9
Liquid Nitrogen	67.0	0.0	0.0	27.0	24.6
Other	0.0	10.0	0.0	9.0	4.3
Sub-total	100.0	100.0	100.0	100.0	100.0

Where a basal application was made in the Bay of Plenty, lime was used in conjunction with potassic and to a lesser extent nitrogen fertiliser. Basal applications in the Waikato emphasised potassic fertiliser possibly associated with a nitrogen fertiliser.

3.5 Fertiliser Response

Sample size prevents a detailed analysis of fertiliser usage, however the following comments are made, based upon the data available. Any interpretation of these results with respect to the fertiliser/yield/gross margin relationship must be treated with caution as other factors were not constant across the sample.

(1) In the Manawatu and Poverty Bay, 50 percent of growers used no basal application, 12:10:10 fertiliser at planting and a side dressing of urea. The following analysis compares the advantages of the most frequently used fertiliser policy.

	Yield (t)	Cost ($) per hectare	Gross Margin ($)
Manawatu			
Other	8.2	105.72	1109.94
Frequently Used	9.3	77.32	1345.85
Poverty Bay			
Other	10.9	117.71	1516.51
Frequently Used	12.5	156.29	1880.42

In the Manawatu the frequently used fertiliser policy was substantially cheaper than alternative policies yet contributed to a yield 0.5 tonnes per hectare greater. These two factors were significant in a gross margin which favoured the frequently used fertiliser policy by $236.00 per hectare.

The same basic fertiliser programme in Poverty Bay cost twice as much as the Manawatu fertiliser indicating higher rates used, thereby making the frequently used fertiliser policy more expensive than alternative programmes. Nevertheless, the frequently used fertiliser policy outyielded other fertiliser policies by 1.6 tonnes per hectare and contributed to a gross margin which was $363.00 per hectare higher.

(2) In the Bay of Plenty the most frequent fertiliser programme undertaken (by 50 percent of the growers surveyed) involved a basal application of potassic super, possibly in combination with lime, a balanced N:P:K fertiliser at planting, and a side dressing of liquid nitrogen.

	Yield (t)	Cost ($) per hectare	Gross Margin ($)
Bay of Plenty			
Other	10.1	153.32	1310.57
Common	9.9	134.56	1142.22

Despite the higher input cost of other fertiliser policies, there appears to be no distinctive yield advantage in the Bay of Plenty. Conversely the lower input cost of the common fertiliser policy is not reflected in the Gross Margin return.

(3) No predominant fertiliser policy was identified for the Waikato.

3.6 Chemical Application

All growers surveyed purchased seed coated with a fungicide and used some form of weedicide, while only 60 percent used an insecticide. Chemical usage is summarised in Table 11.

TABLE 11

Chemical Application 1983-84

	Bay of Plenty	Manawatu	Poverty Bay	Waikato	All Regions
	Proportion of Farms (%)				
Number of Farms Surveyed	12	10	12	11	45
Weedicide					
Atrazine	0.0	50.0	0.0	0.0	11.0
Atrazine + Eradicane	75.0	25.0	8.0	18.0	32.3
Atrazine + Lasso	8.0	0.0	60.0	18.0	22.7
Atrazine + Metalachlor	17.0	0.0	0.0	27.0	11.1
Atrazine + other	0.0	25.0	8.0	27.0	14.1
Lasso	0.0	0.0	16.0	0.0	4.4
Other	0.0	0.0	8.0	9.0	4.4
Sub-total	100.0	100.0	100.0	100.0	100.0
Insecticide					
None	25.0	70.0	60.0	9.0	39.9
Thimet	67.0	0.0	16.0	36.0	31.1
Lorsban	8.0	10.0	0.0	0.0	4.8
Thimet + Lorsban	0.0	0.0	0.0	18.0	4.3
Myral	0.0	0.0	0.0	27.0	6.5
Other	0.0	20.0	24.0	9.0	13.4
Sub-total	100.0	100.0	100.0	100.0	100.0

Atrazine is an effect spray controlling flat and certain grass weeds. Where summer grasses are likely to be a problem other weed sprays, for example Eradicane are used. Eighty percent of all growers surveyed used Atrazine or Atrazine based weedicides. Seventy five percent of Bay of Planty growers used Atrazine plus Eradicane, while 75 percent of the Manawatu growers used either Atrazine alone or Atrazine plus Eradicane. Sixty percent of the Poverty Bay growers used Atrazine plus Lasso. Waikato growers used a more diverse range of chemicals, including Atrazine, Lasso and Primextra.

The majority of the Manawatu and Poverty Bay growers did not use an insecticide. Those that did, favoured Lorsban in the Manawatu and Myral in Poverty Bay. Sixty seven percent of the Bay of Plenty growers used Thimet while 54.0 percent of the Waikato growers used

Thimet and/or Lorsban.

3.7 Chemical Response

Once again sample size prevents a detailed analysis of the responce to chemical usage, however the following comments are made based upon the data available. It should be noted that these results are not considered to imply a chemical usage/production result relationship.

(1) In the Bay of Plenty 50.0 percent of growers used Eradicane plus Atrazine for weed control and Thimet as an insecticide. An analysis of this frequently used chemical policy can be summarised as follows:

	Yield (t)	Chemical Cost ($) per hectare	Gross Margin ($)
Bay of Plenty			
Other	10.0	112.09	1285.78
Frequently Used	10.2	98.18	1162.33

The frequently used chemical policy was marginally cheaper than alternative policies, yet yields were similar. The lower chemical input cost did not reflect in Gross Margin returns.

(2) Seventy two percent of Manawatu growers used Atrazine alone or Atrazine based weedicides with no insecticide. This frequently used chemical policy cost significantly more than alternative chemical policies.

	Yield (t)	Chemical Cost ($) per hectare	Gross Margin ($)
Manawatu			
Other	8.5	32.69	1203.26
Frequently Used	9.0	82.70	1258.56

Yield favoured the frequently used chemical policy by 0.5 tonnes per hectare, a factor not fully reflected in a Gross Margin which was only $55.00 per hectare greater.

(3) Poverty Bay growers implemented a diverse range of chemical programmes. Twenty five percent used Atrazine based weedicides with no insecticide control.

	Yield (t)	Chemical Cost ($) per hectare	Gross Margin ($)
Poverty Bay			
Other	9.9	74.74	1555.47
Frequently Used	12.3	77.44	1669.87

Yield favoured the frequently used chemical policy by 2.6 tonnes per hectare, once again a factor not fully reflected in the Gross Margin return.

(4) As with Poverty Bay the Waikato farmers used a diverse range of chemicals. However, one-third of growers surveyed used Atrazine based weedicides plus either Lorsban or Thimet as an insecticide.

	Yield (t)	Chemical Cost ($) per hectare	Gross Margin ($)
Waikato			
Other	9.98	101.29	1567.07
Frequently Used	9.66	113.94	1143.89

The frequently used chemical policy cost nearly $14.00 per hectare more than alternative policies, yet production per hectare was a third of a tonne lower, a factor fully reflected in the lower Gross Margin per hectare.

3.8 Harvesting

Maize is either harvested with the kernals left on the cob or stripped from the cob at harvest (picker-shelled). The picker-shelled maize ears are plucked from the plants, the husks stripped off then the cobs shelled. The combines will usually handle only four rows, and grain is delivered to a jockey bus alongside or directly into trucks. The grain is artificially dried.

Twenty five percent of Bay of Plenty growers, 50.0 percent in the Manawatu, 38.0 percent in Poverty Bay and 9.0 percent of Waikato growers had their own combines and usually undertook off-farm contracting. Seventeen percent of Poverty Bay growers had both combines and pickers (for cribbed maize).

3.8.1 Harvest Date

This is influenced by weather, availability of contractors, grain moisture content, and more particularly by the time taken by the variety to mature.

The 1984 harvest started around 15 June. Given the cool windy climate the Manawatu harvest was 13 days later in starting while the

Poverty Bay harvest was 15 days earlier.

3.8.2 Drying

All picker-shelled maize is artificially dried. Cribbed maize is dried in 'mesh-towers' under a roof but exposed to drying winds. Poverty Bay has traditionally crib dried maize; one-third of the growers cribbed maize in this region.

Artificial drying reduces the moisture content to around 14.0 percent from, typically, 26 percent (ranging between 20-34 percent). Dryers are either gas, oil or occasionally wood fired, invariably requiring skill, time and money to operate.

There were no maize growers with driers visited in the Bay of Plenty area, but 55.0 percent of the Manawatu growers and 8.0 percent of the Poverty Bay and Waikato growers visited had driers. These growers usually undertook contract drying work as well. Any other grain not farm dried is dried by the merchant or the processor, e.g. N.Z. Starch (Watties).

SECTION 4

MAIZE COSTS AND RETURNS

This section details the costs and returns per hectare of maize harvested and per tonne of maize sold. The information is detailed in Table 12 and summarised below.

TABLE 12

Maize Costs and Returns Summary 1983-84

	Bay of Plenty	Manawatu	Poverty Bay	Waikato	All Regions
Number of Farms Surveyed	12	10	12	11	45
Yield per hectare (t)	10.1	9.0	11.4	9.8	10.1
Per Hectare ($)					
Revenue	2006	1817	2212	2036	2018
Variable Costs	891	707	823	876	827
Gross Margin	1115	1110	1389	1160	1191
Machinery Overheads	231	226	226	198	220
Gross Margin less Machinery Overheads	884	884	1163	962	971
Per Tonne ($)					
Revenue	199	202	194	208	200
Variable Costs	88	79	72	89	82
Gross Margin	111	123	122	119	118
Machinery Overheads	23	26	20	20	22
Gross Margin less Machinery Overheads	88	97	102	99	96

The All Regions gross revenue of $2018.00 per hectare required $827.00 of variable cost inputs plus machinery overheads of $220.00 per hectare resulting in a gross margin less machinery overheads of $971.00 per hectare or $96.00 per tonne sold.

Proximity to end user is the dominant factor in determining the gross revenue per tonne, a factor favouring both the Waikato and Manawatu regions. The higher quality of cribbed maize produced in Poverty Bay is not reflected in gross revenue per tonne data.

The high per hectare production of the Poverty Bay region offset the low value per tonne to achieve the highest regional revenue per hectare. This revenue advantage was not offset by higher variable costs or machinery overheads with the result that Poverty Bay showed the highest gross margin and gross margin less machinery overhead returns.

All other regions showed similar gross margins per hectare. High per tonne revenue in the Waikato allowed this region to offset below average production and absorb significant contracting charges. The high level of contracting charges is reflected in lower machinery overheads thereby giving the Waikato a marginal advantage over both the Bay of Plenty and the Manawatu when assessed on the basis of gross margin less machinery overheads.

TABLE 13

Maize Costs and Returns per Hectare 1983-84
($/ha)

	Bay of Plenty	Manawatu	Poverty Bay	Waikato	All Regions
Number of Farms Surveyed	12	10	12	11	45
Sources of Revenue:					
Picker-shelled Maize	1981.88	1795.85	1507.89	2036.20	1842.59
Cribbed Maize	0.00	0.00	675.65	0.00	157.81
Sold Standing	0.00	0.00	28.87	0.00	6.74
Insurance Claim	24.01	21.59	0.00	0.00	11.23
Total Revenue	2005.89	1817.44	2212.41	2036.20	2018.37
Expenditure:					
Machinery Running Costs					
Fuel and Oil	41.69	46.57	51.13	22.87	39.86
Repairs & Maintenance	51.21	81.99	106.75	60.40	73.91
Labour	34.46	30.59	38.94	36.34	35.11
Sub-Total	127.36	159.15	196.82	119.61	148.88

TABLE 13 (cont...)

Maize Costs and Returns per Hectare 1983-84

			($/ha)		
Contracting Charges					
Cultivation	0.61	0.00	0.00	10.97	3.18
Drilling	23.38	24.33	17.79	28.21	23.62
Fertiliser Spreading	11.11	4.84	3.62	8.99	7.31
Spraying	19.88	2.08	3.21	0.99	6.60
Heading	56.95	54.67	70.53	124.77	78.26
Sub-Total	111.93	85.92	95.15	173.93	118.97
Seed	92.04	90.63	68.10	95.52	87.08
Fertiliser					
Planting	119.20	44.30	47.04	65.56	70.06
Side Dressing	28.91	41.77	82.27	63.48	53.90
Sub-Total	148.11	86.07	129.31	129.04	123.96
Chemicals					
Weedicides	82.94	71.01	69.66	76.99	75.41
Insecticides	23.98	5.38	6.74	31.09	17.56
Sub-Total	106.92	76.39	76.40	108.08	92.97
Cartage					
Crop Inputs	12.44	2.45	4.32	6.15	6.48
Crop Output	78.03	59.75	106.10	103.30	85.97
Sub-Total	90.47	62.20	110.42	109.45	92.45
Grain Drying	212.69	134.80	147.22	140.53	159.31
Crop Insurance	1.34	11.44	0.00	0.00	3.02
Total Variable Costs	890.86	706.60	823.42	876.16	826.64
Gross Margin	1,115.03	1,110,84	1,388.99	1,160.04	1,191.73
Machinery Overheads					
Depreciation	129.12	124.89	124.23	108.96	121.44
Opportunity Cost of Capital	102.26	101.52	101.87	88.91	98.32
Total Machinery Overheads	231.38	226.41	226.10	197.87	219.76
Gross Margin less Machinery Overheads	883.65	884.43	1,162.89	962.17	971.97

4.1 Cost Components

Table 14 summarises the major cost components per hectare of maize harvested.

TABLE 14

Maize Cost Components 1983-84

	Bay of Plenty		Manawatu		Poverty Bay		Waikato		All Regions	
	$/ha	%	$/ha	%	$/ha	%	$/ha	%	$/ha	%
Number of Farms Surveyed	12		10		12		11		45	
Machinery Costs										
Running Costs	127		159		197		120		140	
Overheads	231		226		226		198		220	
Contracting	112		86		95		174		119	
Sub-Total	470	41.9	471	50.5	518	49.4	492	45.8	488	46.7
Seed	92	8.2	91	9.8	68	6.5	96	8.9	87	8.3
Fertiliser	148	13.2	86	9.2	129	12.3	129	12.0	124	11.9
Chemicals	107	9.6	76	8.2	76	7.3	108	10.1	93	8.9
Cartage	90	8.0	62	6.7	110	10.5	109	10.1	92	8.8
Drying	213	19.0	135	14.5	147	14.0	141	13.1	159	15.2
Insurance	1	0.1	11	1.1	-	-	-	-	3	0.2
Total Costs	1121	100.0	932	100.0	1048	100.0	1075	100.0	1046	100.0

Nearly 62 percent of the total costs of growing maize are associated with machinery and drying costs, a more detailed analysis of which is presented in Table 15.

TABLE 15

Detailed Machinery and Drying Costs
($/ha)

	Bay of Plenty	Manawatu	Poverty Bay	Waikato	All Regions
Number of Farms Surveyed	12	10	12	11	45
Growing					
Fuel and Oil	35	36	40	19	32
Repairs and Maintenance[a]	43	64	84	51	60
Labour	25	25	29	22	25
Sub-Total	103	125	153	92	117
Overheads[a]	193	176	178	167	177
Sub-Total	296	301	331	259	294
Contracting	55	31	25	49	41
Total	351	332	356	308	335
Harvesting					
Fuel and Oil	7	10	11	4	8
Repairs and Maintenance[a]	8	18	23	9	14
Labour	10	6	10	15	10
Sub-Total	25	34	44	28	32
Overheads[a]	38	50	48	30	42
Sub-Total	63	84	92	58	74
Contracting	57	55	70	125	79
Total	120	139	162	183	153
Drying					
Own	-	39	3	-	10
Contracting	213	96	144	141	149
Total	213	135	147	141	159

a Proportional according to fuel usage

It is apparent that the overhead costs associated with the machinery involved in growing and harvesting are the single major cost component. Any attempt to spread these costs over a greater acreage or to reduce the capital investment in machinery would improve the profitability of maize production.

Drying costs are the next most important item. Despite seasonal variations it is apparent the drying costs are a major cost component being twice the cost of contract harvesting. The low drying costs relative to yield of Poverty Bay should be noted and once again emphasise the importance of cribbed maize in this region.

4.2 Alternative Crops

Table 16 compares the per hectare returns from wheat for the 1983-84 season with both the All Regions average for maize plus the Manawatu regional financial returns, the latter being the major area for North Island wheat production.

TABLE 16

Maize and Wheat Financial Comparison 1983-84
($/ha)

	MAIZE		WHEAT
	All Regions	Manawatu	North Island [a]
Gross Revenue	2018	1817	1091
Expenditure			
Machinery Running Costs			
Fuel and Oil	40	47	31
Repairs and Maintenance	74	82	34
Labour	35	30	24
Sub-Total	149	159	89
Contracting Charges			
Cultivation	3	0	5
Drilling	24	24	3
Fertiliser Spreading	7	5	4
Spraying	7	2	13
Heading	78	55	102
Sub-Total	119	86	127

TABLE 16 (cont...)

Maize and Wheat Financial Comparison 1983-84
($/ha)

Seed	87	91	70
Fertiliser			
Planting	70	44	74
Topdressing	54	42	18
Sub-Total	124	86	92
Chemicals			
Weedicides	75	71	24
Insecticides	18	5	3
Fungicides	-	-	11
Sub-Total	93	76	38
Cartage			
Crop Inputs	6	2	5
Crop Output	86	60	51
Sub-Total	92	62	56
Grain Drying and Bags	159	135	11
Insurance	3	11	5
Total Variable Costs	826	707	488
Gross Margin	1192	1111	603
Machinery Overheads			
Depreciation	121	125	52
Opportunity Cost of Capital	98	102	44
Total Machinery Overheads	219	226	96
Gross Margin less Machinery Overheads	973	884	507

a Source: Economic Survey of New Zealand Wheatgrowers 1983-84

Per unit of land, ignoring the time the respective crops are actually in the ground, the gross margin for maize in the Manawatu exceeds the gross margin for wheat by $508 per hectare, while the per

hectare gross margin less machinery overheads for maize is $377 greater than wheat. This clearly indicates that due to high gross revenue the high machinery overheads associated with maize production are absorbed within the total maize cost structure making maize considerably more profitable than wheat. Ministry of Agriculture and Fisheries data would support this conclusion. Gross margins for a range of enterprises in the Manawatu are summarised in Table 17.

TABLE 17

Manawatu Crop and Livestock Gross Margins 1983-84

	Production	$ Per Hectare
Livestock:		
Factory Supply	290 kg MF/ha	923
Breeding Ewe Prime Lamb	18 Ewes/ha	422
Breeding Ewe Store Lambs	13 Ewes/ha	343
Prime Beef	4 Weaners/ha	430
Beef Breeding	2.5 Cows/ha plus replacements	402
Bull Beef	4 Dairy Bulls/ha	684
Red Deer	9 Deer/ha	1606
Crops		
Wheat	4.7 t/ha	392
Barley Feed	4.3 t/ha	371
Barley Malting	5.0 t/ha	510
Maize	8.0 t/ha	649
Feed Peas	4.0 t/ha	443
Ryegrass Seed	700 kg/ha	390
Sweetcorn	17 t/ha	927
Process Peas	5.0 t/ha	691
Asparagus	3.75 t/ha	3212
Potatoes	37 t/ha	2866
Mangolds	100 t/ha	1433
Lucerne Hay	500 bales/ha	888

Source: Ministry of Agriculture and Fisheries, Palmerston North.

While the actual gross margin cannot be compared with those detailed in Table 18 it is apparent that maize production is more profitable than wheat, barley and sheep production, comparable to bull

beef and process pea production, but less profitable than either factory supply dairying or intensive crop production. It should be noted that differences in land use intensity between maize and the alternatives will alter this financial comparison. Maize occupies the land for 12 months of the year while the alternatives allow for more flexible land use and a combination of enterprises on the same land over a year.

An alternative measure of the relative profitability of maize production is to express the gross margin less machinery overheads as a percentage of the per hectare capital value of the land. This comparison assumes that the capital value of land in part reflects the intensity of the alternative land use options.

TABLE 18

Maize Production Related to Land Values

	Bay of Plenty	Manawatu	Poverty Bay	Waikato	All Regions
Number of Farms Surveyed	12	10	12	11	45
Gross Margin less Machinery Overheads ($/ha)	884	884	1163	962	971
Capital Value ($/ha)	5906	2772	4585	6663	5039
Gross Margin less Machinery Overheads as % of Capital Value	15.0	31.9	25.4	14.4	19.3

This analysis would suggest that the alternative land use options are considerably more profitable than maize in the Bay of Plenty and Waikato, while maize is more competitive with other enterprises in the Manawatu and Poverty Bay. Due to the influence of alternative enterprises, causing land values to be higher in the Bay of Plenty and the Waikato, maize production is a more competitive enterprise in the Manawatu and Poverty Bay areas than in the Bay of Plenty or the Waikato. Therefore maize production could be expected to expand in the Manawatu and Poverty Bay areas.

4.3 Variation in Maize Production Systems

4.3.1 Cribbed maize

Table 19 compares cribbed maize with picker-shelled maize in the Poverty Bay East Coast area.

TABLE 19

Artificial Drying Versus Crib Drying Systems
(Poverty Bay)

	Combine + Driver $/ha	Cob Harvest + Crib $/ha
Costs:		
Planting & Husbandry	408	408
Harvest Costs	259	277 [a]
Drying 25% to 14% at $20.50 per tonne	246	- [b]
Cartage at $7.17 per tonne	86	-
Crib Cost	-	55 [c]
Shelling Costs $12 per tonne at 10.0 t	-	120
Cartage at $7.17 per tonne	-	71
Interest on profit 14 percent/6 months	-	88
Total Expenses	999	1019
Income:		
Maize 10 t at $200 per tonne	2000	2000
Storage increment at $20 per tonne		200
Gross Margin	1001	1180

a Includes transport to and filling of crib

b Average grain moisture loss of 2-3 percent per month for 3 months

c Crib cost $7400 (73m x 1.2m x 4m) depreciated at 10 percent. Capacity 180 t, 20-year life.

Total costs are similar for both systems, the only financial advantage attributed to cribbed maize being the storage increment of

$20 per tonne. Further development of cribbed maize would be considered by growers if the higher quality of cribbed maize was reflected in the price offered. Currently there is no premium for quality.

4.3.2 Maize silage

Ministry of Agriculture officials at the 1984 Large Herd Conference claimed that at a price equivalent of $4.00 per bale, maize silage showed a gross margin of $2,396 per hectare while at $3.00 per bale the gross margin was estimated at $1,230 per hectare. This conclusion would suggest that at an equivalent of $3.00 per bale, maize silage and maize grain equate with each other but that at $4.00 per bale, maize silage is considerably more profitable than maize grain. Maize silage rather than maize grain is therefore favoured in predominantly dairying districts.

4.3.3 Maize production utilising surplus capacity

Maize production is frequently used to reduce the demand on labour or the pressure on milking shed capacity. In this instance maize substitutes for additional cows. Table 20 summarises the return from a factory supply herd in the Waikato and compares this return with maize.

TABLE 20

Substitution of Maize for Dairy Cattle in the Waikato

	Factory Supply		Maize
	Per Cow	Per Hectare	Per Hectare
Gross Revenue	648	1944	2036
Variable Costs including Depreciation	88	264	985
Gross Margin	560	1680	1051
Less Opportunity Cost of Capital $750 at 14 percent[a]	105	315	89
Gross Margin less Opportunity Cost Capital	455	1365	962
Less Labour at $0.80 per kg B.F.	132	396	-
Gross Margin less Overheads	323	969	962

a Dairy Board Consulting Officer per. comms.

This analysis would suggest that the incremental capital investment required to milk additional cows can be justified provided the additional cows can be handled within the existing labour force. If additional labour has to be hired on contract milking rates in order to handle the increase in cow numbers then the return from maize equates with the return from dairying.

4.4 Comparison of Californian and New Zealand Maize Returns

Table 21 compares the All Regions Maize returns for New Zealand producers with the maize returns for growers in the Butte and Glenn Counties, California.

TABLE 21

MAIZE COSTS AND RETURNS NEW ZEALAND AND CALIFORNIA
1983-84

($NZ/ha)

	NEW ZEALAND	CALIFORNIA (b)
Production (t/ha)	10.0	10.0
Gross Revenue	2018	2570
Variable Costs		
Machinery Overhead Costs	149	562
Contract Charges	119	13
Seed	87	123
Fertiliser	124	347
Chemicals	93	138
Cartage	92	29
Grain Drying	159	121
Irrigation	-	394
Sundry	3	40
Total Variable Costs	826	1767
Gross Margin	1191	803
Machinery Overheads		
Depreciation	121	190
Opportunity Cost of Capital	98	127
Total Machinery Overheads	219	317
Gross Margin less Machinery Overheads	972	486

a $NZ = $US0.46

b Source Co-operative Extension University of California.

This analysis reflects the high cost structure of Maize production in California. Californian variable costs are twice that experienced by New Zealand growers while machinery overheads are nearly 50 percent higher. Combined this results in a gross margin less machinery overheads half that of the New Zealand producer.

SECTION 5

CONCLUSION

It is suggested that future maize production will be centered in the non dairying central North Island regions of the Manawatu and Poverty Bay. In these regions production will be part of a balanced cropping livestock policy. In the South Auckland-Bay of Plenty region, competing land use options will restrict an increase in maize areas, although in these regions maize will continue to be grown by those dairy farmers not wishing to employ additional labour. Increased returns for wheat are only likely to replace maize to the extent that the shorter growing season can be efficiently utilised by arable producers.

On the basis of one year's data collected, future production oriented research programmes for maize should therefore centre on the Manawatu and Poverty Bay regions with specific emphasis on:

(a) variety trials by regions;

(b) weedicide and insecticide programmes which reflect increased returns per hectare; and

(c) better utilisation of plant and machinery.

Payment for quality should be introduced with the result that research into the following areas will be important:

(a) crib maize drying techniques; and

(b) on farm drying and grain handling procedures.

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